

Enclosure B-2  
**Integrated Steelmaking and Forming Segment Information**  
**Possible BAT/NSPS/Pretreatment Options**

**!     *Clean Water Act Requirements***

The Clean Water Act requires that EPA periodically review and revise, as appropriate, categorical, technology-based effluent limitations guidelines and standards for use in the NPDES permit and pretreatment programs. The Act identifies three types of pollutants that must be regulated by the effluent limitations guidelines and standards, and specifies six levels of treatment for existing and new dischargers, as follows:

*Types of pollutants*

Conventional:	TSS, BOD <sub>5</sub> , oil & grease, pH, and fecal coliform.
Priority:	Cyanide; designated priority metal pollutants (e.g., chromium, lead, mercury, nickel, selenium, zinc); and designated priority organic pollutants (e.g., benzene, benzo- <i>a</i> -pyrene, naphthalene, 2,3,7,8-TCDD (dioxin)).
Nonconventional:	Pollutants that are not designated as conventional or priority, but which may exhibit toxic effects in aquatic ecosystems or to humans (e.g., ammonia-N, chlorine, phenols (4AAP), dissolved iron, COD, and, 2,3,7,8-TCDF (furan)).

*Levels of Categorical Effluent Limitations Guidelines and Standards*

BPT - Best Practicable Control Technology Current Available  
BCT - Best Conventional Pollutant Control Technology  
BAT - Best Available Technology Economically Achievable  
NSPS - New Source Performance Standards  
PSES - Pretreatment Standards for Existing Sources  
PSNS - Pretreatment Standards for New Sources

BPT, BCT and, BAT are applicable to existing direct dischargers; PSES are applicable to existing indirect dischargers; and NSPS and PSNS are applicable to new direct and new indirect dischargers, respectively. Generally, discharges of all types of pollutants may be regulated at BPT and at NSPS; discharges of only conventional pollutants are regulated at BCT; and discharges of toxic and nonconventional pollutants are regulated at BAT and at PSES and PSNS.

As part of its review of 40 CFR Part 420, EPA is considering whether to revise categorical effluent limitations guidelines and standards for all pollutants of concern in the iron and steel industry at all levels of treatment.

## **!      *Current 40 CFR Part 420 - Integrated Steelmaking and Forming***

For purposes of this review, EPA is considering integrated steelmaking and forming operations to include the following processes typically operated at integrated steel mills: sintering, ironmaking in blast furnaces, basic oxygen furnace steelmaking, ladle metallurgy including vacuum degassing, continuous casting, ingot casting, and hot forming.

### *Pollutants Limited*

40 CFR Part 420 limits conventional, nonconventional, and priority pollutants for integrated steelmaking and forming operations, as follows:

#### **Sintering, Ironmaking**

	<u>BPT</u>	<u>BAT</u>	<u>BCT</u>	<u>NSPS</u>	<u>PSES/PSNS</u>
Total Suspended Solids	✓		✓	✓	
Oil & Grease <sup>a</sup>	✓		✓	✓	
Ammonia-N <sup>b</sup>	✓	✓		✓	✓
Total Cyanide <sup>b</sup>	✓	✓		✓	✓
Phenols (4AAP) <sup>b</sup>	✓	✓		✓	✓
Total Lead		✓		✓	✓
Total Zinc		✓		✓	✓
Total Residual Chlorine <sup>c</sup>		✓		✓	✓
pH	✓		✓	✓	

<sup>a</sup> Applicable to sintering operations only

<sup>b</sup> Applicable to sintering operations when cotreated with ironmaking

<sup>c</sup> Applicable when treatment includes chlorination

#### **Steelmaking, Vacuum Degassing, Continuous Casting**

	<u>BPT</u>	<u>BAT</u>	<u>BCT</u>	<u>NSPS</u>	<u>PSES/PSNS</u>
Total Suspended Solids	✓		✓	✓	
Oil & Grease <sup>a</sup>	✓		✓	✓	
Total Lead		✓		✓	✓
Total Zinc		✓		✓	✓
pH	✓		✓	✓	

<sup>a</sup> Applicable to continuous casting operations only

### Hot Forming

	<u>BPT</u>	<u>BAT</u>	<u>BCT</u>	<u>NSPS</u>	<u>PSES/PSNS</u>
Total Suspended Solids	✓		✓	✓	
Oil & Grease	✓		✓	✓	
pH	✓		✓	✓	

#### *Technology Basis*

For sintering operations with wet air pollution controls, the major components of EPA's model BAT treatment systems for the current regulation include collection of wet air pollution control scrubber water; solids removal in a thickener; recycle of approximately 90% of the process water; and treatment of the blowdown stream for metals. The regulation provides that effluent limitations guidelines and standards for ammonia-N, total cyanide, and phenols (4AAP) apply when sintering wastewaters are cotreated with wastewaters from blast furnace operations. The effluent limitations and standards for total residual chlorine also apply when chlorination is used for treatment of sintering and blast furnace wastewaters. The EPA model BAT treatment system for blast furnace gas cleaning and cooling water is similar to that for sintering process water, with the addition of a mechanical draft cooling tower in the recycle loop to provide for blast furnace gas cooling and moisture control.

The EPA model treatment system for basic oxygen furnaces with semi-wet air pollution controls incorporates a zero discharge standard for water used for gas conditioning prior to a dry air pollution control system. For basic oxygen furnaces equipped with wet air pollution controls (open combustion and suppressed combustion), the EPA model treatment systems comprise thickeners for solids removal, high rate recycle, and treatment of low-volume blowdowns for metals.

For vacuum degassing, the EPA model BAT treatment system for the current regulation includes solids removal, cooling, high-rate recycle, and blowdown treatment for metals. The model BAT treatment system for continuous casters includes solids and oil removal in a scale pit, additional treatment for solids and oil with pressure filters, cooling, high-rate recycle, and blowdown treatment for metals.

For hot forming mills, the EPA model treatment systems comprise mill scale and oil removal in scale pits, partial recycle from the scale pits for flume flushing at certain types of mills, supplemental solids and oil removal in roughing clarifiers and pressure filters, and partial recycle of treated process waters. The current effluent limitations guidelines and standards are based on an overall process water recycle rate of 65% for hot forming mills.

Except for hot forming mills, EPA model treatment systems for NSPS, PSES, and PSNS for the above integrated steelmaking operations are the same as the respective BAT model treatment systems. For hot forming mills, NSPS are based on 96% recycle of process wastewaters. There are no categorical PSES or PSNS applicable to hot forming operations in the

current regulation. Ladle metallurgy operations other than vacuum degassing and ingot casting are dry processes that are not regulated under the current Part 420.

## **!      *Possible Revisions to Part 420***

### *Pollutants to be Limited*

In addition to pollutants currently limited, EPA is considering whether to establish effluent limitations guidelines and standards for additional metal and organic pollutants for integrated steelmaking and forming operations. The specific pollutants have not been identified at this time.

### *Preliminary BAT/NSPS/PSES/PSNS Technology Options*

*Sintering*      Figure 6 presents schematic diagrams of two preliminary BAT treatment technology trains and three NSPS options. (Figures 1 through 5 were presented in the materials on cokemaking operations.) Each treatment train is described briefly below:

*BAT/NSPS Option A* includes high-rate recycle as described above for the current regulation and blowdown treatment for toxic metals by hydraulic and waste loading equalization, lime precipitation, and filtration.

*BAT/NSPS Option B* incorporates the technologies used in *Option A* and adds alkaline chlorination for treatment of residual levels of ammonia-N, total cyanide, and phenols (4AAP).

*NSPS Option C* is a zero discharge option based on dry air pollution controls for new source sintering operations.

*Ironmaking*      Figure 7 presents schematic diagrams of the following four preliminary BAT/NSPS treatment technology trains. Each treatment train is described briefly below:

*BAT/NSPS Option A* includes high-rate recycle as described above for the current regulation and zero discharge based on hydraulic equalization and evaporation of blowdown on blast furnace slag. This option is considered feasible for blast furnaces with adjacent slag processing operations and where owners or operators have provided secure slag pits to prevent ground water contamination from excess water applied for slag cooling. This option may also be used for disposal of a portion of the blast furnace blowdown where it is not feasible to evaporate the entire blowdown.

*BAT/NSPS Option B* incorporates the high-rate recycle system from *Option A*, hydraulic and waste loading equalization, and treatment of toxic metals with chemical precipitation and filtration.

*BAT/NSPS Option C* incorporates the technologies used in *Option B* and adds alkaline chlorination for treatment of residual levels of ammonia-N, total cyanide, and phenols (4AAP).

*BAT/NSPS Option D* incorporates the technologies used in *Option B* and adds a biological nitrification system for supplemental treatment of ammonia-N.

*BOF Steelmaking* Figures 8, 9, and 10 present preliminary BAT/NSPS options for basic oxygen furnaces (BOFs) equipped with semi-wet, wet-open combustion, and wet-suppressed combustion air pollution control systems, respectively. Each treatment train is described briefly below:

*BOF Semi-wet (Figure 8):* Two BAT/NSPS options are being considered for Semi-wet BOFs, neither of which incorporates the zero discharge standard in the current regulation. EPA has found that the model technology for the current regulation may no longer be an appropriate basis for effluent limitations guidelines and standards. It does not appear to account for effective operation of air pollution control systems. Effective operation of those systems result in intermittent process wastewater discharges at some mills and continuous discharges at others. The options under consideration include chemical precipitation and filtration for those systems with relatively low or intermittent wastewater flows; and, similar treatment and high-rate recycle of process waters with blowdown filtration for those systems with relatively high process wastewater flow rates.

*BOF Wet-Open Combustion (Figure 9):* The two options presented for Wet-Open Combustion BOFs include primary solids separation and recycle at the furnaces. The remaining flow is treated by additional solids separation and recycled at a high rate. The blowdown from the recycle system is treated by chemical precipitation and filtration for treatment of toxic metals. The differences between Options A and B are use of carbon dioxide as a water softening agent in Option B and increased recycle.

*BOF Wet-Suppressed Combustion (Figure 10):* Both preliminary options for Wet-Suppressed Combustion BOFs include primary solids separation and recycle at the furnaces as described above for Wet-Open Combustion, followed by additional solids separation, use of carbon dioxide as a water softening agent, and high-rate recycle of the remaining flow. Option A is a near zero discharge option where a blowdown is discharged only on an intermittent basis to correct chemical or hydraulic imbalances. Option B is similar to Option A except that the continuous blowdown would be treated with chemical precipitation and filtration for treatment of toxic metals.

*Vacuum Degassing (Figure 11):* The single BAT/NSPS option currently under consideration for vacuum degassing operations includes a high-rate recycle system with cooling of the entire flow, side stream solids removal with lime/chemical precipitation for metals removal, and filtration of the blowdown for effluent polishing.

*Continuous Casting (Figure 12):* The single BAT/NSPS option currently under consideration for continuous casters includes a scale pit for scale and oil removal, additional solids and oil removal

in a roughing clarifier and pressure filters, cooling, and high-rate recycle. The recycle system blowdown is treated by chemical precipitation and filtration for supplemental toxic metals removal.

*Hot Forming (Figure 13):* The single BAT/NSPS option currently under consideration for hot forming operations incorporates mill scale and oil removal in scale pits, additional solids and oil removal in a roughing clarifier and pressure filters, cooling, and high-rate recycle (i.e., > 95%).

The preliminary PSES/PSNS options currently under consideration for integrated steelmaking and forming operations are the same as the preliminary BAT/NSPS options described above.

It is important to note that while effluent limitations are established based upon the performance of specific technologies, owners or operators of integrated steel mills may use any combination of process changes, process water recycle and reuse, and end-of-pipe wastewater treatment technologies to comply with the numerical effluent limitations guidelines and standards.

#### *Best Management Practices*

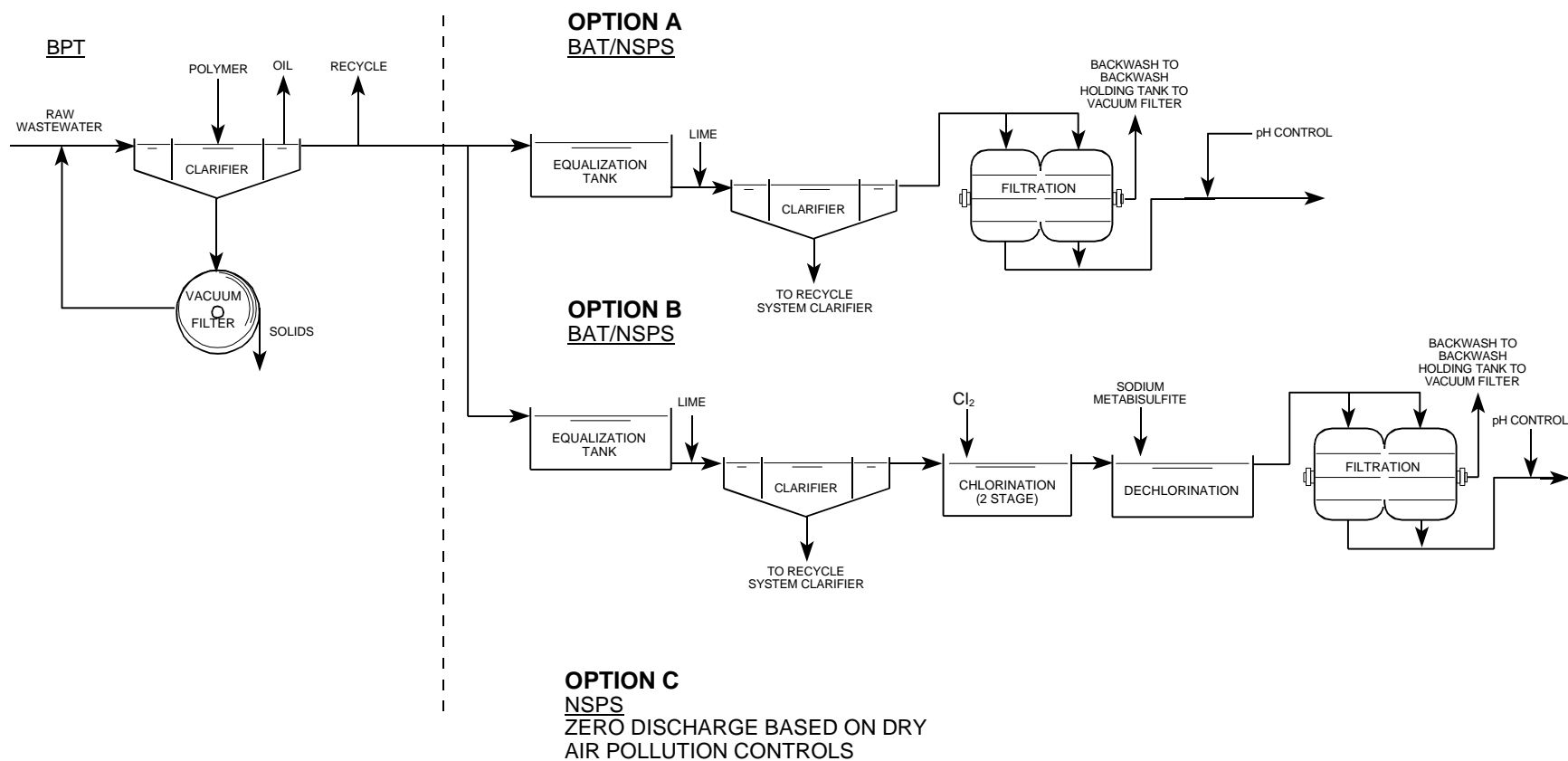
EPA is considering whether to include in a revised Part 420 the following best management practices for integrated steelmaking and forming operations:

- Collection and treatment of storm water from the immediate process area;
- Control of runoff from raw material and product storage areas;
- Control of blast furnace gas drip legs and condensates;
- Surveillance and corrective action programs for blast furnace noncontact cooling water systems;
- Use of blast furnace process water blowdown streams for moisture control of sinter plant burden;
- Cascade of vacuum degassing and continuous casting process water blowdown streams to BOF air pollution control scrubber water treatment and recycle systems;
- Oil loss control programs for lubrication systems on hot forming mills; and
- Routine visual observation and corrective action programs for oil at process wastewater and noncontact cooling water outfalls.


#### *Regulatory Flexibility*

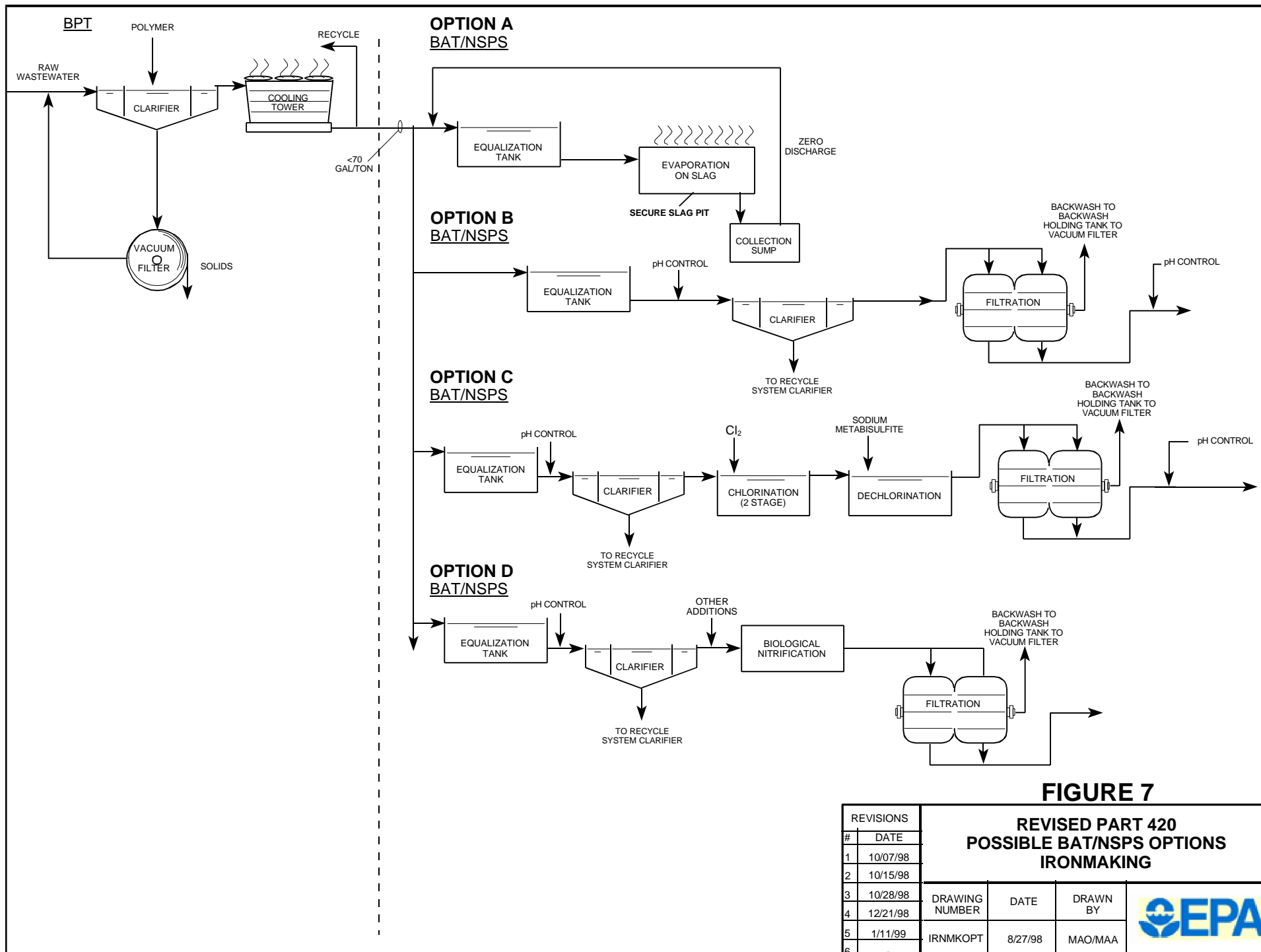
EPA is also considering whether to amend the *water bubble* rule at 40 CFR §420.03 to allow for expanded pollutant trades involving integrated steelmaking and forming operations. Although not yet formulated, EPA may consider incentive programs as part of BAT which could, for example, provide for extended compliance schedules in exchange for advance levels of treatment.

EPA invites comments on these and alternate approaches to regulating integrated steelmaking and forming operations.




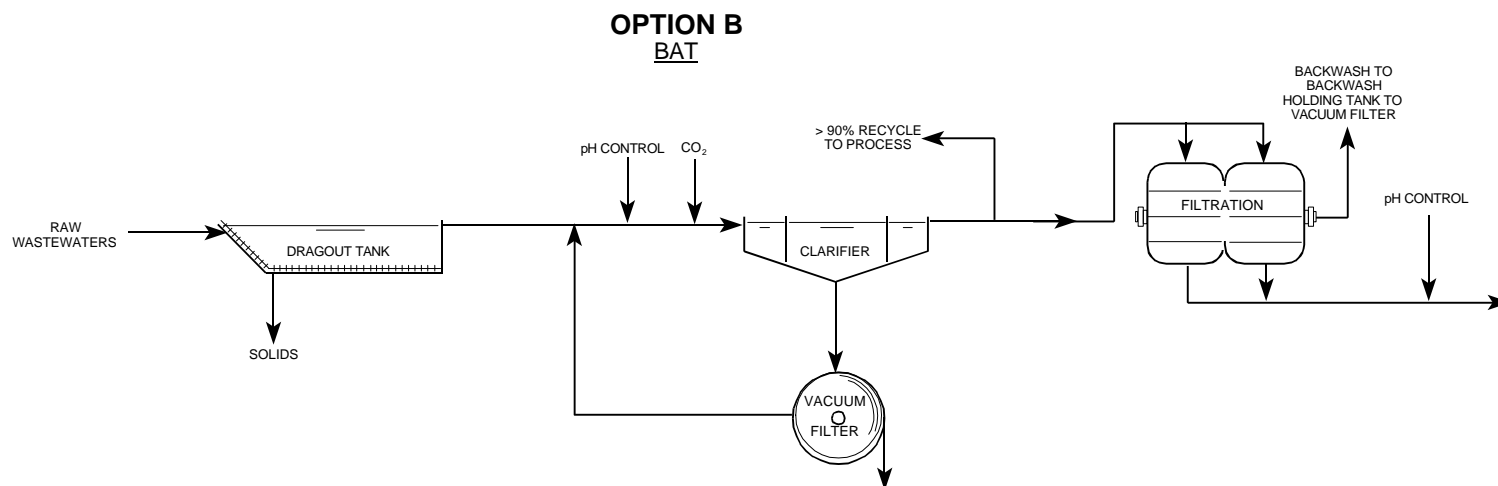
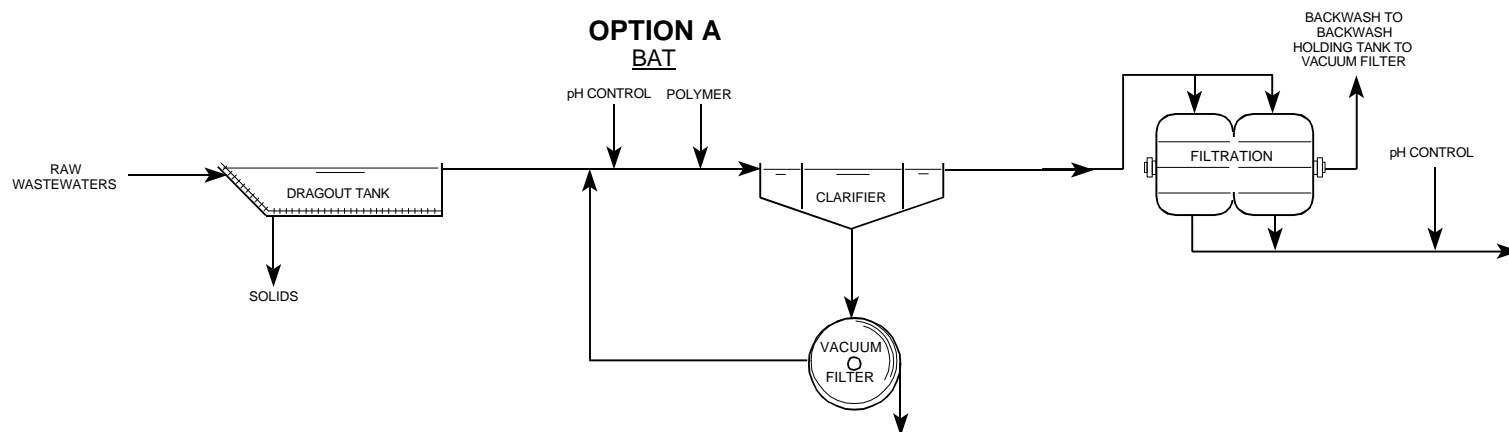
**FIGURE 6**

REVISIONS		REVISED PART 420 POSSIBLE BAT/NSPS OPTIONS SINTERING				
#	DATE					
1	10/07/98	DRAWING NUMBER	DATE	DRAWN BY		
2	10/15/98					
3	10/28/98					
4	11/10/98					
5	12/21/98	SINTROPT	08/27/98	MAO/MAA		
6	1/11/99					




**FIGURE 7**

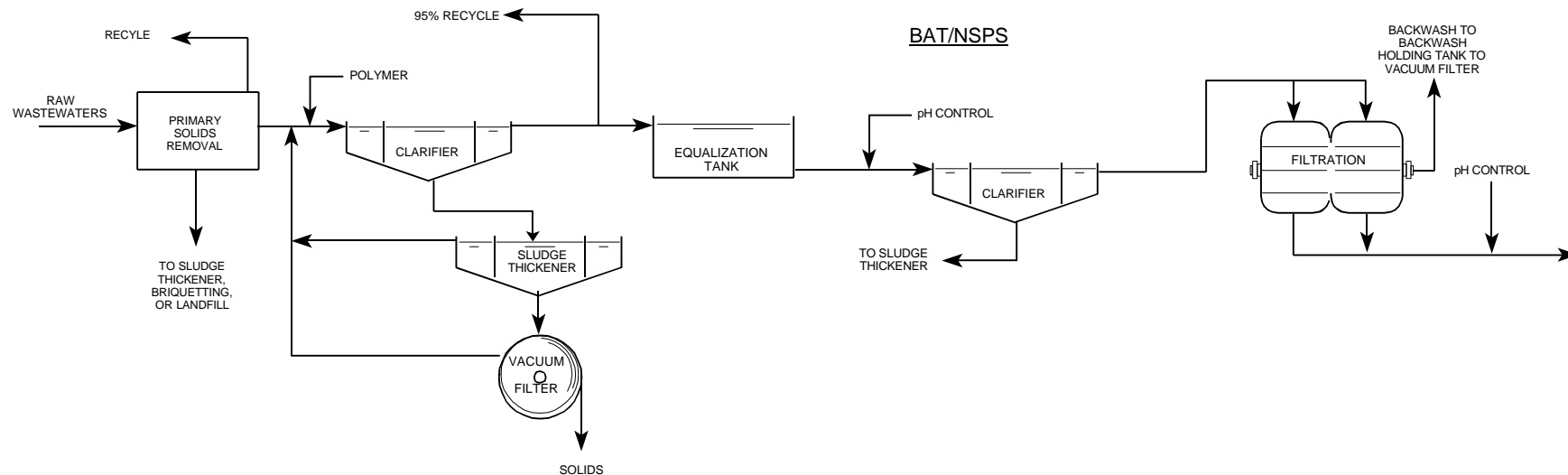
REVISIONS		REVISED PART 420 POSSIBLE BAT/NSPS OPTIONS IRONMAKING			
#	DATE	DRAWING NUMBER	DATE	DRAWN BY	
1	10/07/98				
2	10/15/98				
3	10/28/98				
4	12/21/98				
5	1/11/99	IRNMKOPT	8/27/98	MAO/MAA	
6	-				



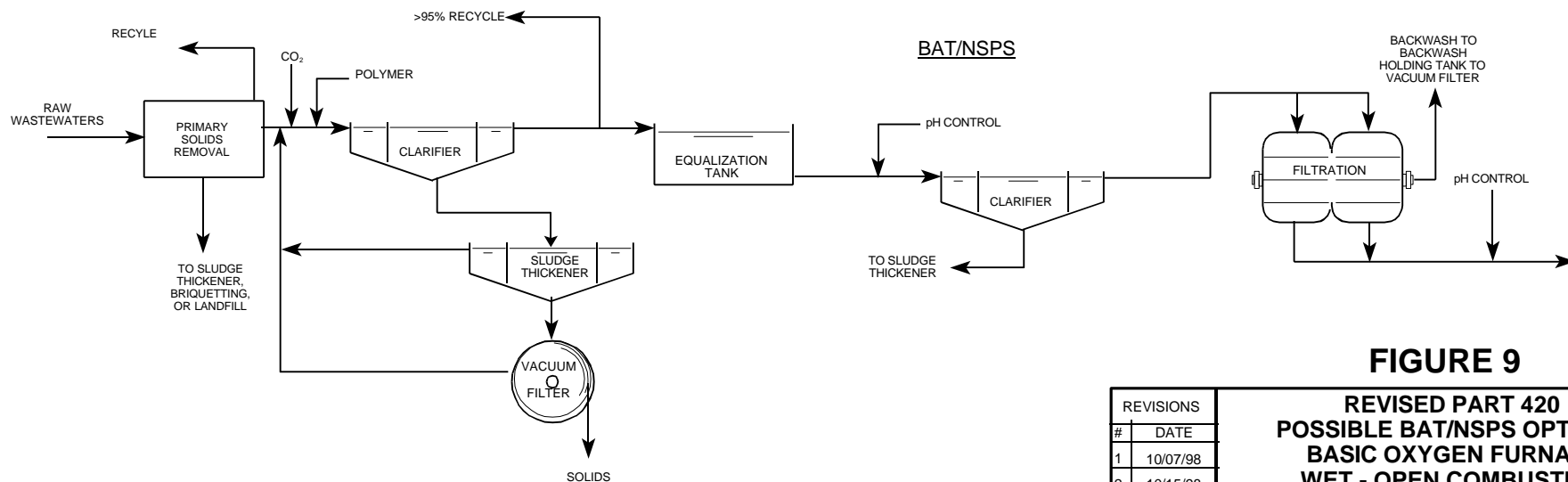
**FIGURE 8**

REVISIONS		REVISED PART 420 POSSIBLE BAT/NSPS OPTIONS BASIC OXYGEN FURNACE - SEMI WET			
#	DATE				
1	10/07/98	DRAWING NUMBER	DATE	DRAWN BY	
2	10/15/98				
3	10/28/98				
4	11/06/98				
5	12/21/98				
6	1/11/99	BOFSWOPT	08/27/98	MAO/MAA	

### OPTION A



### OPTION B

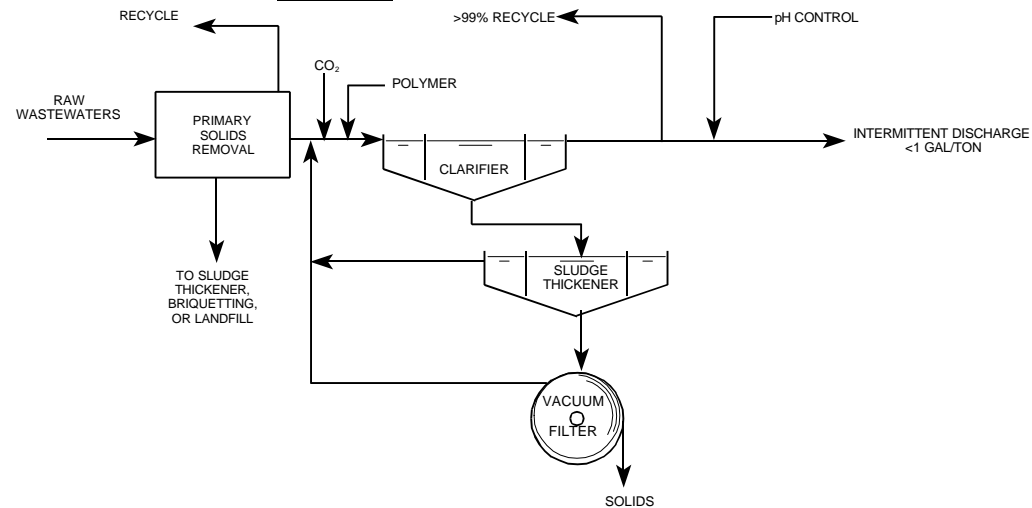


**FIGURE 9**

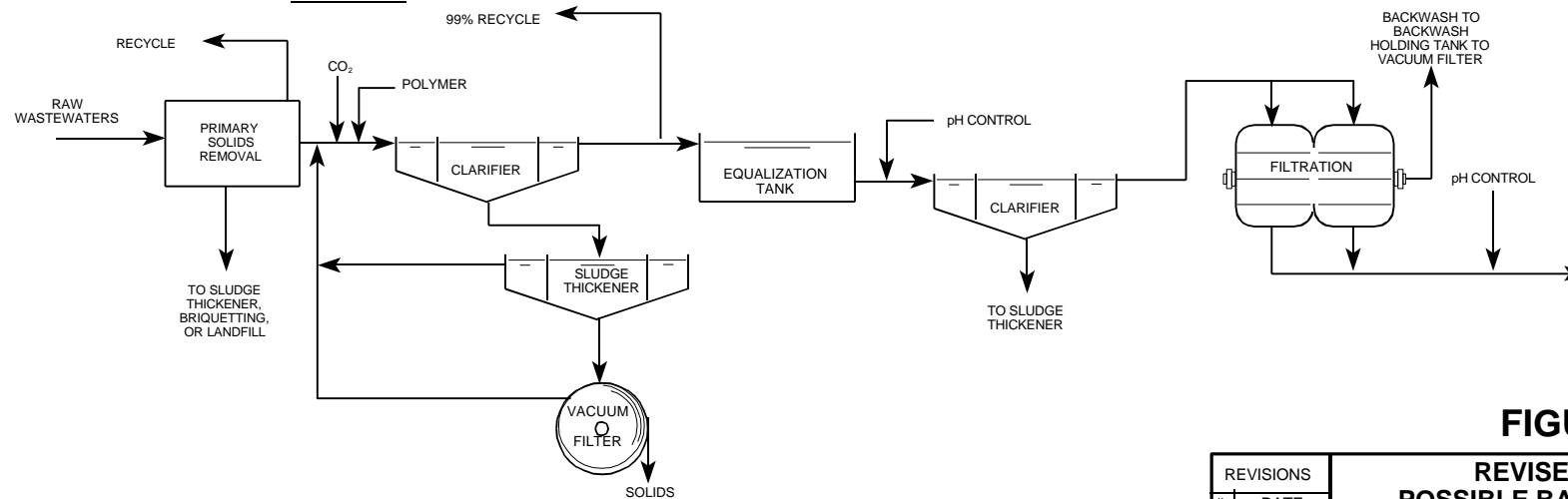
REVISIONS		REVISED PART 420 POSSIBLE BAT/NSPS OPTIONS BASIC OXYGEN FURNACE WET - OPEN COMBUSTION		
#	DATE			
1	10/07/98	DRAWING NUMBER	DATE	DRAWN BY
2	10/15/98			
3	10/28/98			
4	11/06/98	WOCOPT	8/27/98	MAO/MAA
5	12/21/98			
6	1/11/99			



### OPTION A BAT/NSPS



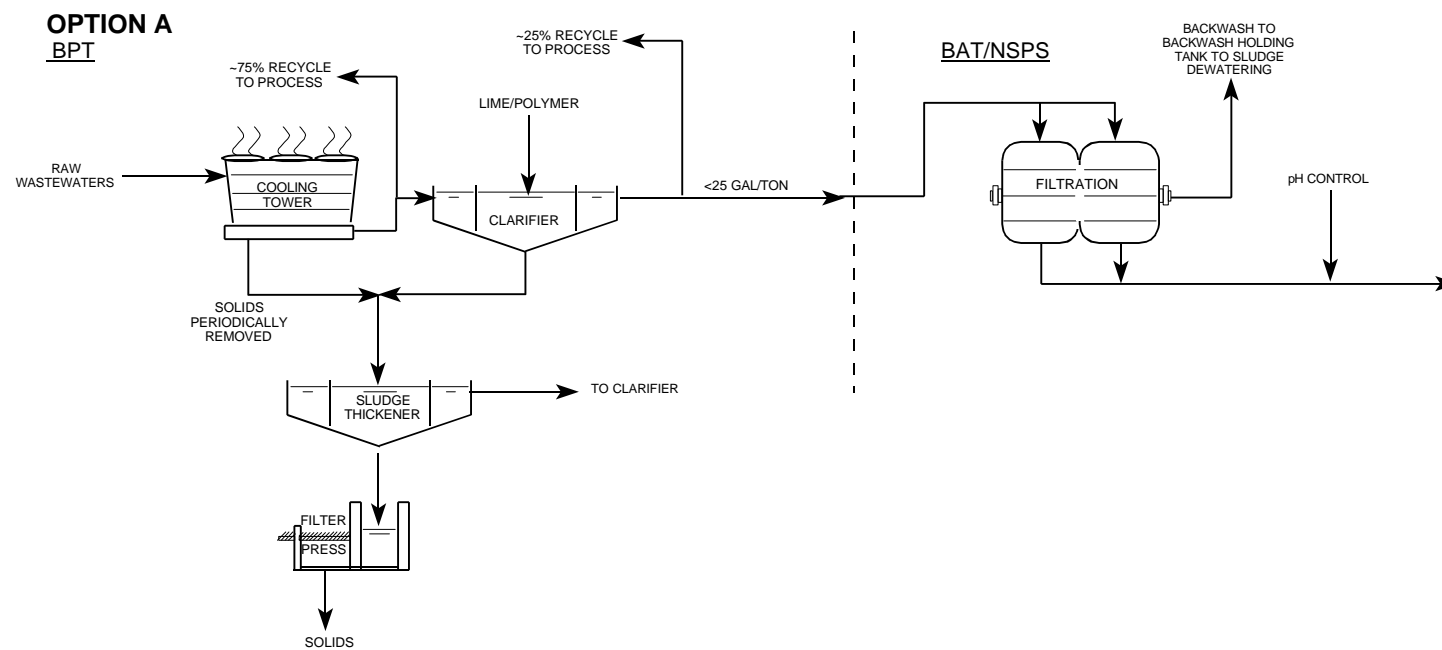
### OPTION B BAT/NSPS




**FIGURE 10**

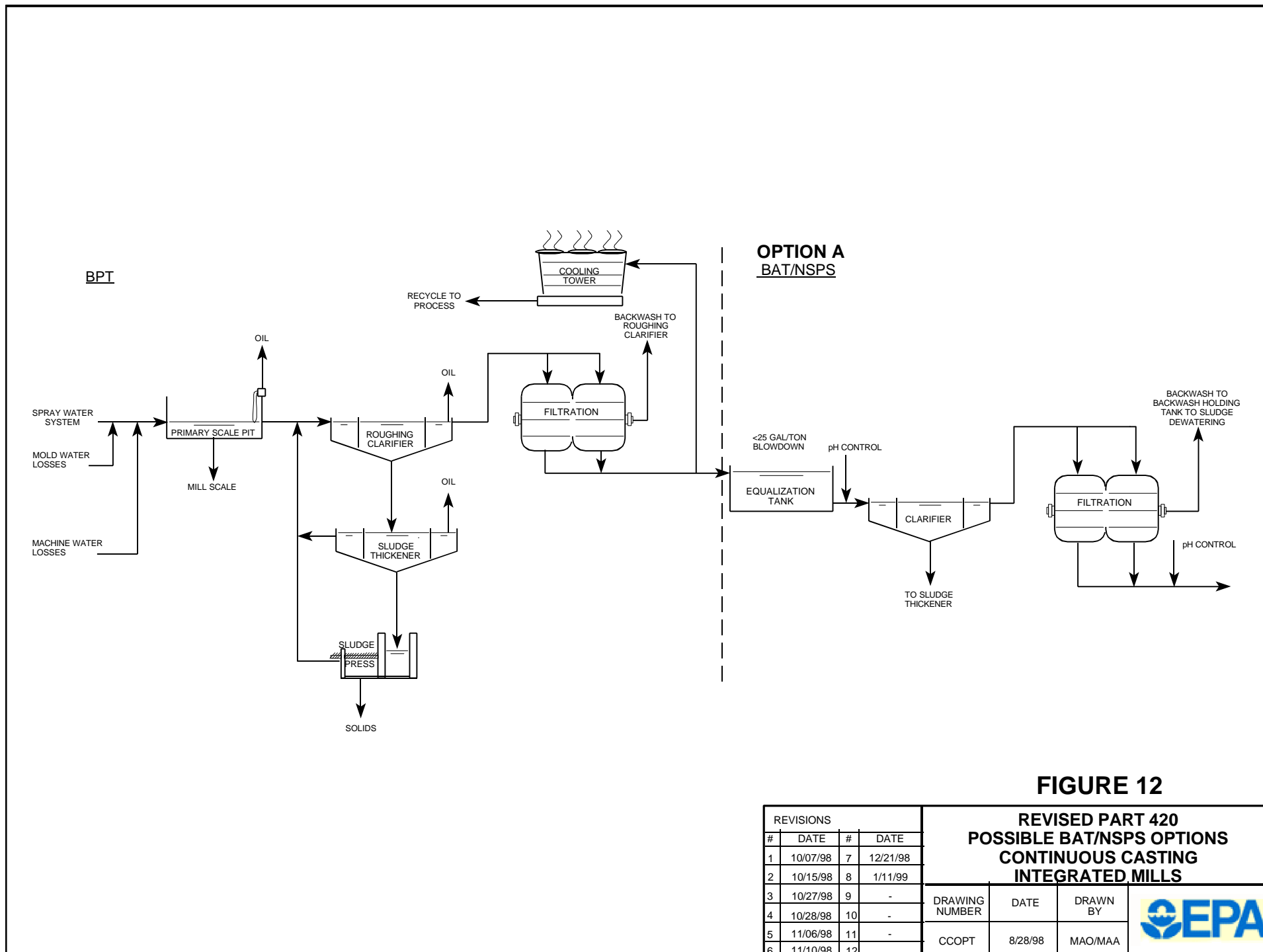
REVISIONS		REVISED PART 420 POSSIBLE BAT/NSPS OPTIONS BASIC OXYGEN FURNACE WET - SUPPRESSED COMBUSTION		
#	DATE	DRAWING NUMBER	DATE	DRAWN BY
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2	10/15/98			
3	10/28/98			
4	11/06/98			
5	12/21/98			
6	1/11/99	WSCOPT	8/27/98	MAO/MAA





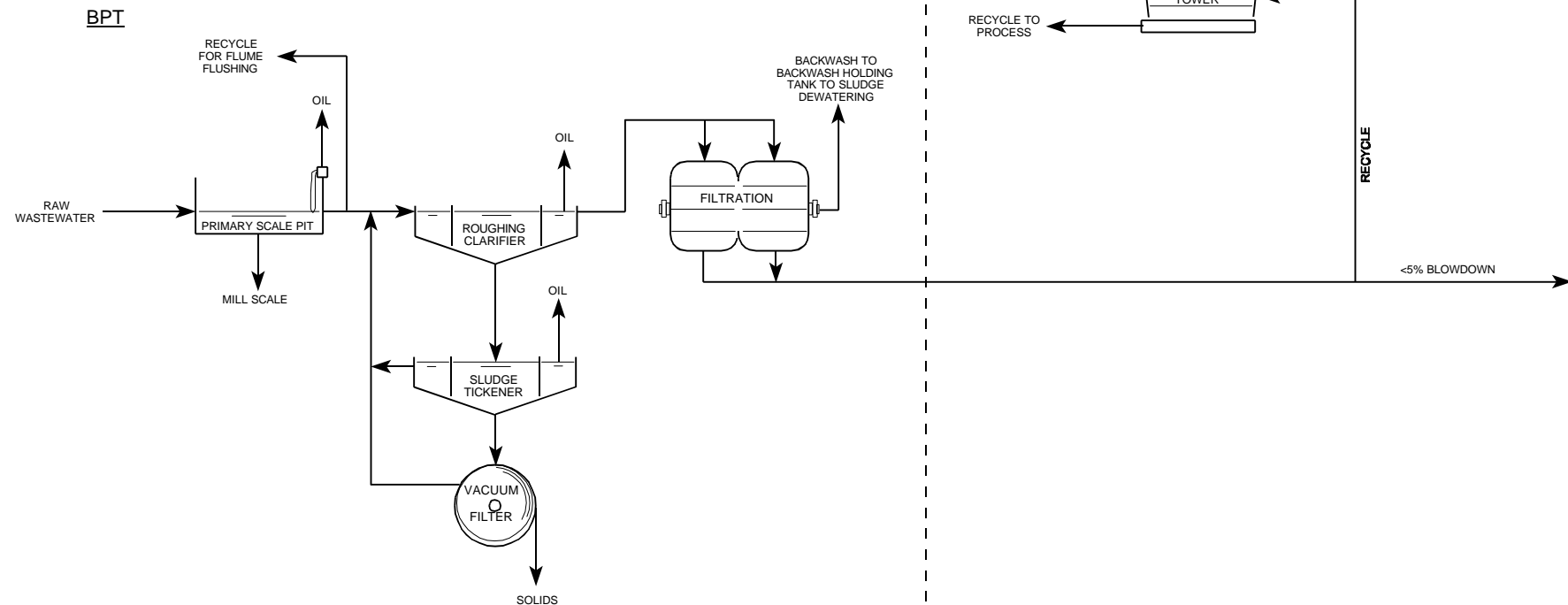
**FIGURE 11**

REVISIONS		REVISED PART 420 POSSIBLE BAT/NSPS OPTIONS VACUUM DEGASSING			
#	DATE	DRAWING NUMBER	DATE	DRAWN BY	
1	10/07/98				
2	10/15/98				
3	10/28/98				
4	11/06/98				
5	12/21/98				
6	1/11/99	VACOPT	8/28/98	MAO/MAA	

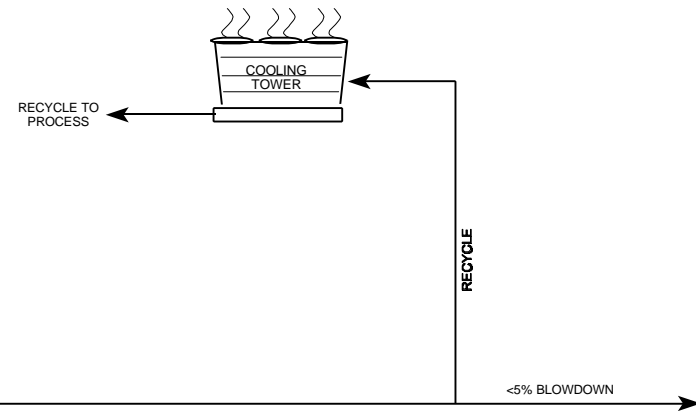


**FIGURE 12**

REVISIONS				REVISED PART 420 POSSIBLE BAT/NSPS OPTIONS CONTINUOUS CASTING INTEGRATED MILLS			
#	DATE	#	DATE				
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2	10/15/98	8	1/11/99				
3	10/27/98	9	-				
4	10/28/98	10	-				
5	11/06/98	11	-				
6	11/10/98	12	-				
				CCOPT	8/28/98	MAO/MAA	




## OPTION A - CARBON STEEL MILLS BAT/NSPS



NOTE: FOR HOT STRIP MILLS, RUN-OUT TABLE WATER MAY BE COOLED AND RECYCLED DIRECTLY WITH SIDE-STREAM TREATMENT FOR SOLIDS

**FIGURE 13**

REVISIONS				REVISED PART 420 POSSIBLE BAT/NSPS OPTIONS HOT FORMING- INTEGRATED AND STAND-ALONE MILLS			
#	DATE	#	DATE	DRAWING NUMBER	DATE	DRAWN BY	
1	10/07/98	7	12/21/98				
2	10/15/98	8	1/11/99				
3	10/27/98	9	-				
4	10/28/98	10	-				
5	11/06/98	11	-	HTFRMOPT	8/28/98	MAO/MAA	
6	11/10/98	12	-				